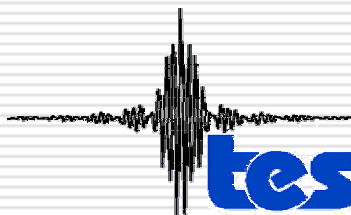
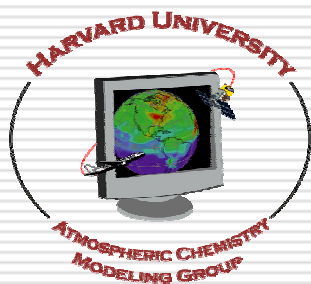




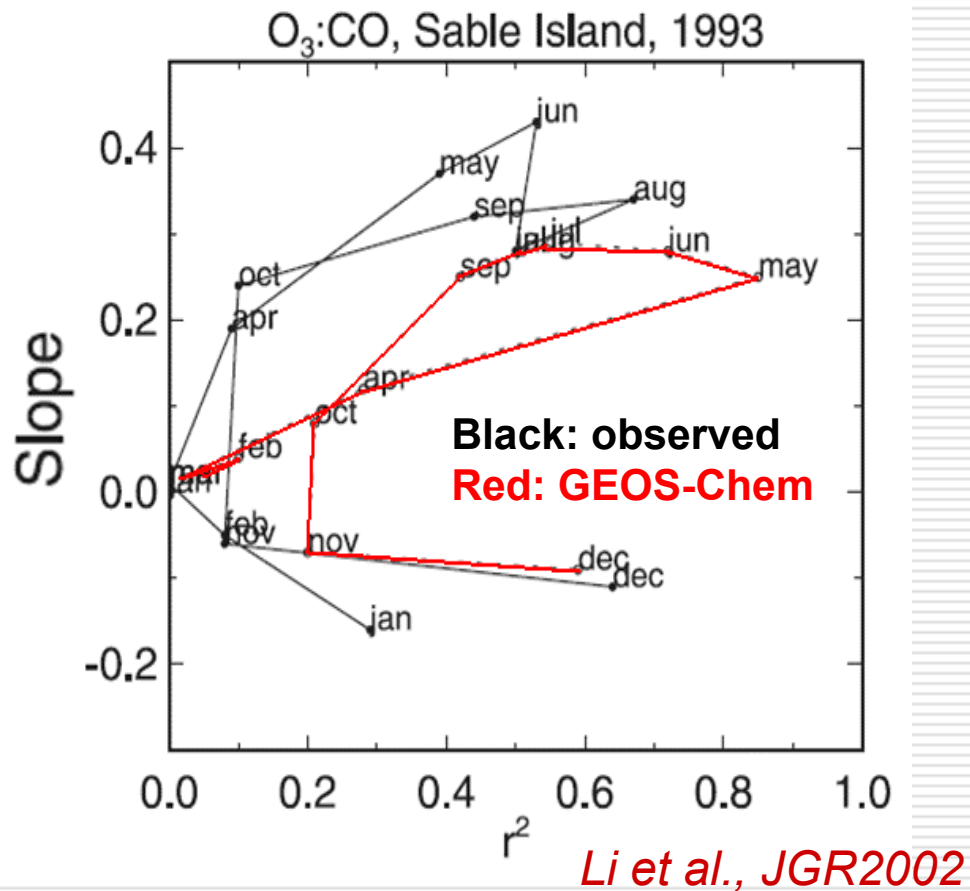
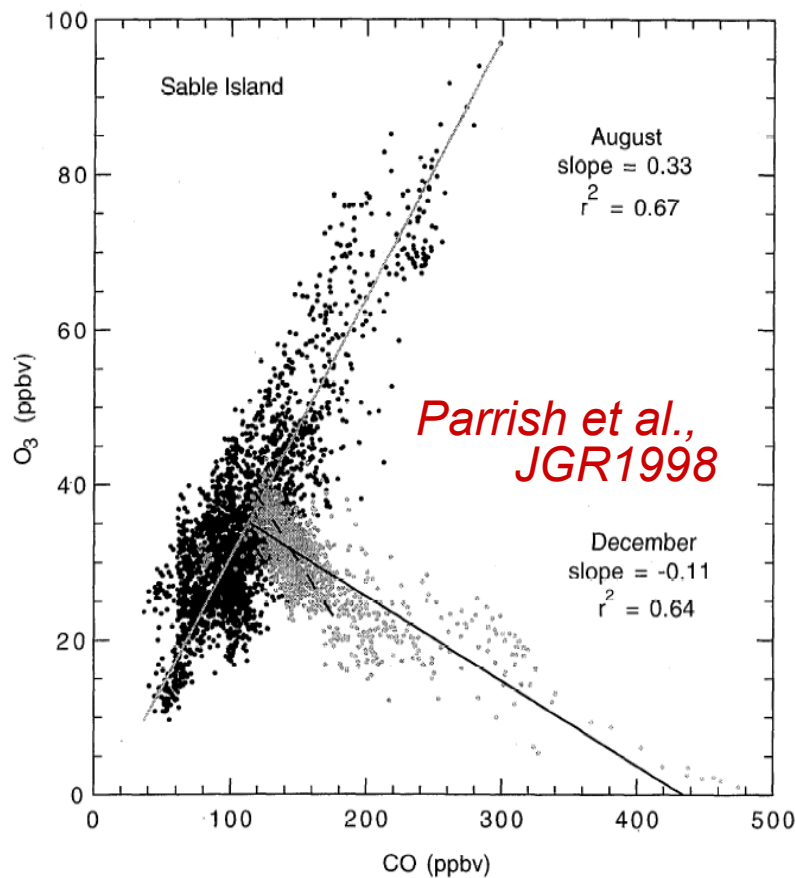
Continental outflow and intercontinental transport of ozone pollution as determined by O₃-CO correlations from TES

Lin Zhang, Daniel J. Jacob, Kevin W. Bowman, Jennifer A. Logan, Solène Turquety, Rynda C. Hudman, Qinbin Li, Reinhard Beer, Helen M. Worden, John R. Worden, Curtis P. Rinsland, Susan S. Kulawik, Michael C. Lampel, Mark W. Shephard, Brendan M. Fisher, Annmarie Eldering, Melody A. Avery



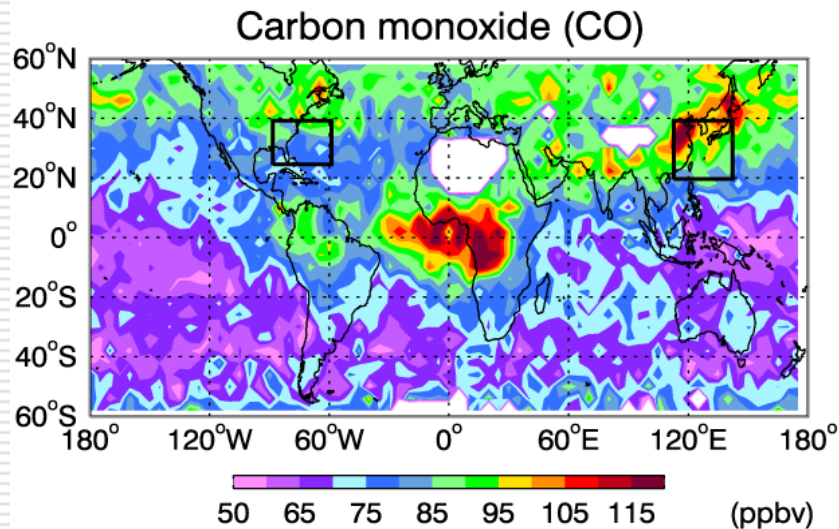
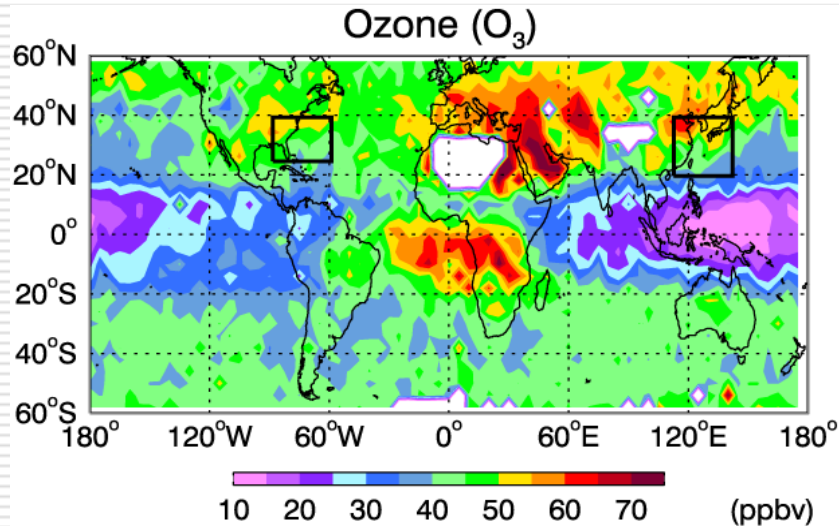
Aura Science and Validation Team Meeting
Sep 11, 2006

O₃-CO correlation: Indicator of ozone production

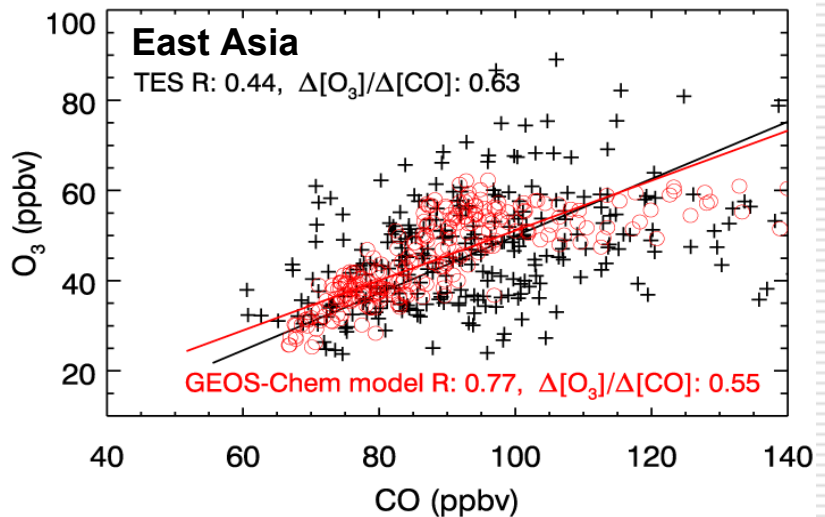
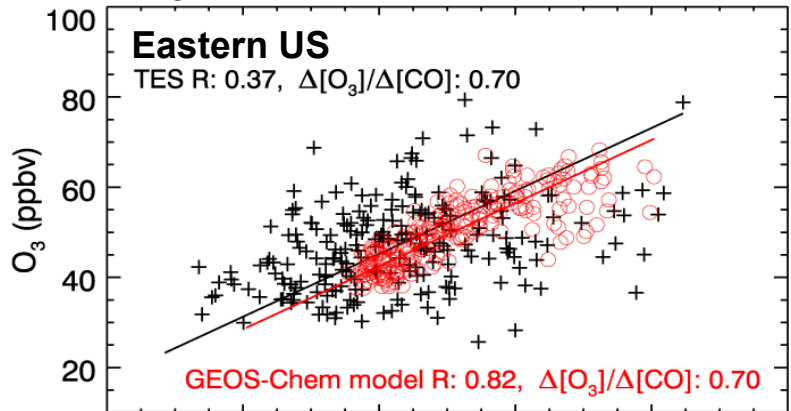


O₃-CO correlations in surface and aircraft data have been used to test understanding of ozone production but the data are sparse.

TES ozone and CO observations in July 2005 at 618 hPa

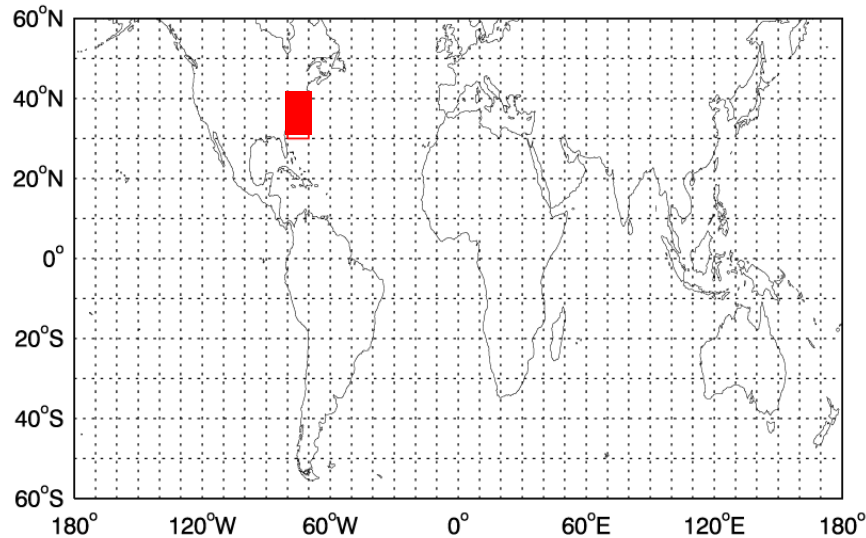


O_3 -CO correlations in continental outflow

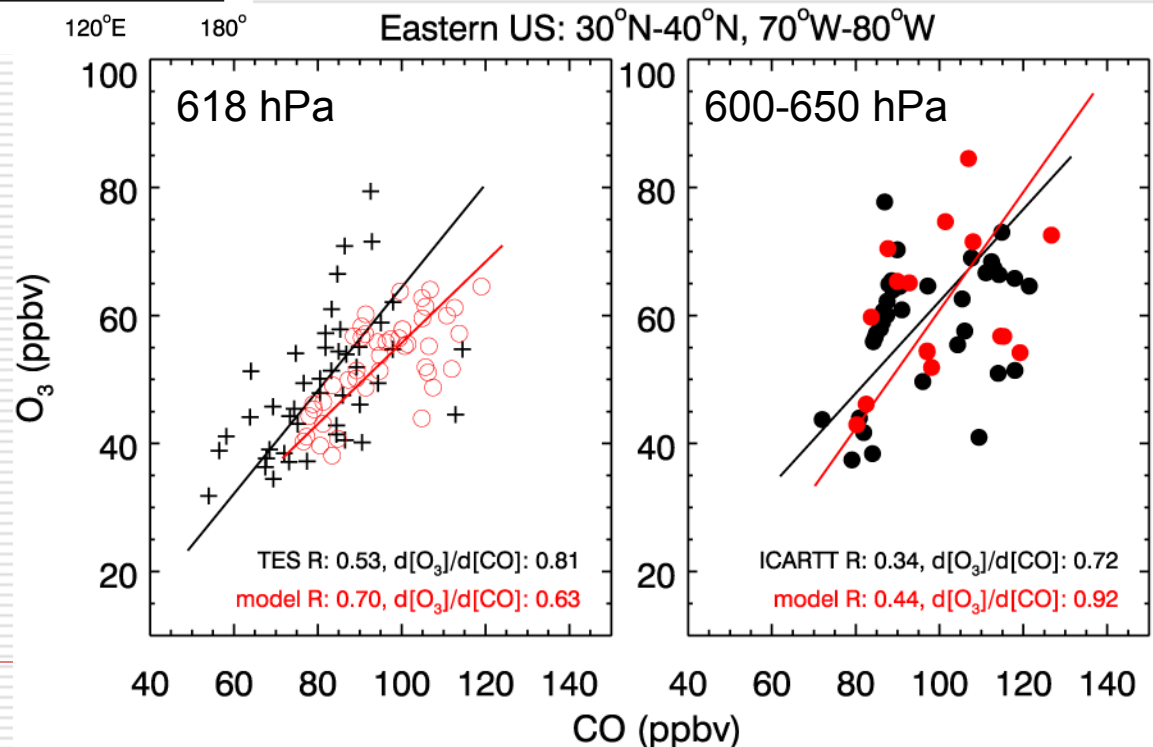


TES and model show positive O_3 -CO correlations in continental outflow suggesting ozone export from polluted regions.

Deriving ozone-CO correlations from TES data



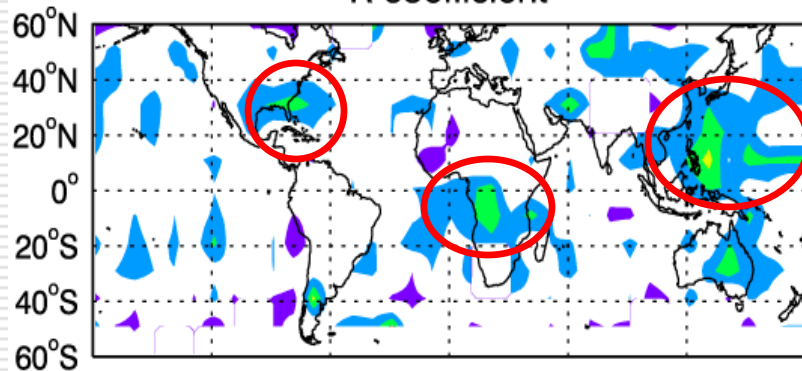
- Divide the globe into $10^\circ \times 10^\circ$ cells
- In each cell, calculate the O_3 -CO correlation and regression coefficients for each month. Each cell has 20-60 data points for July 2005.



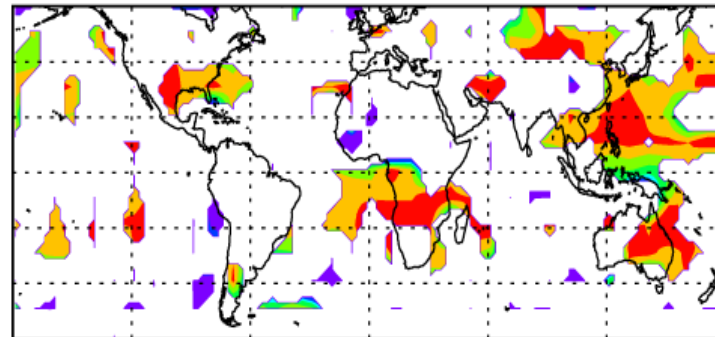
Global distribution of the O₃-CO correlation

July 2005

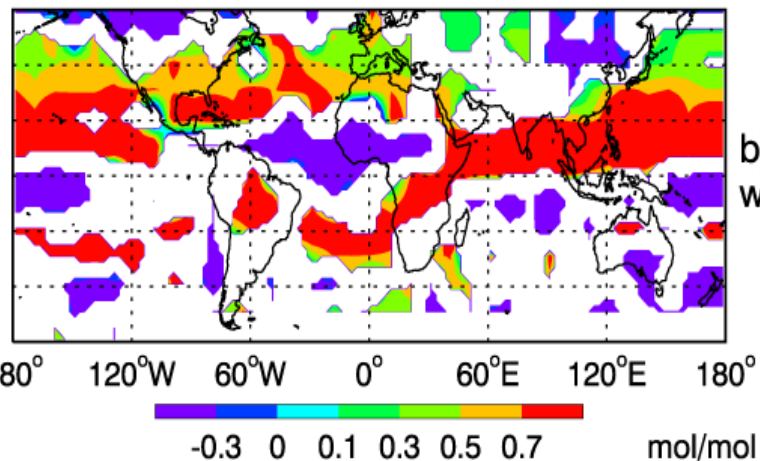
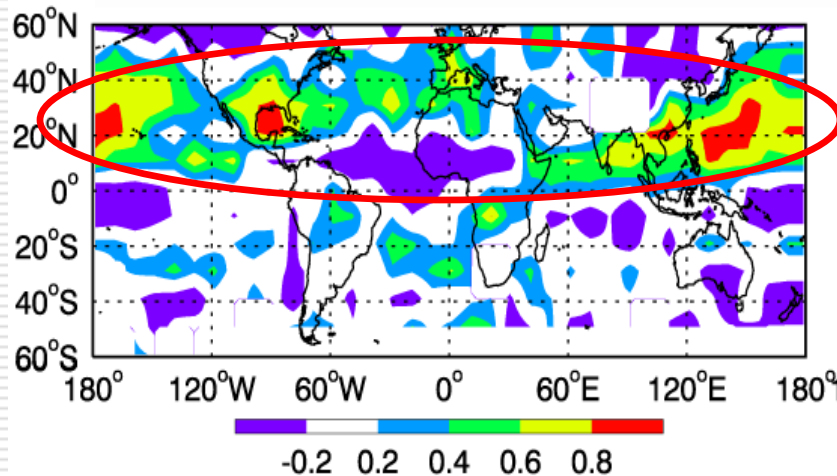
R coefficient



d[O₃]/d[CO] at 618 hPa



a) TES

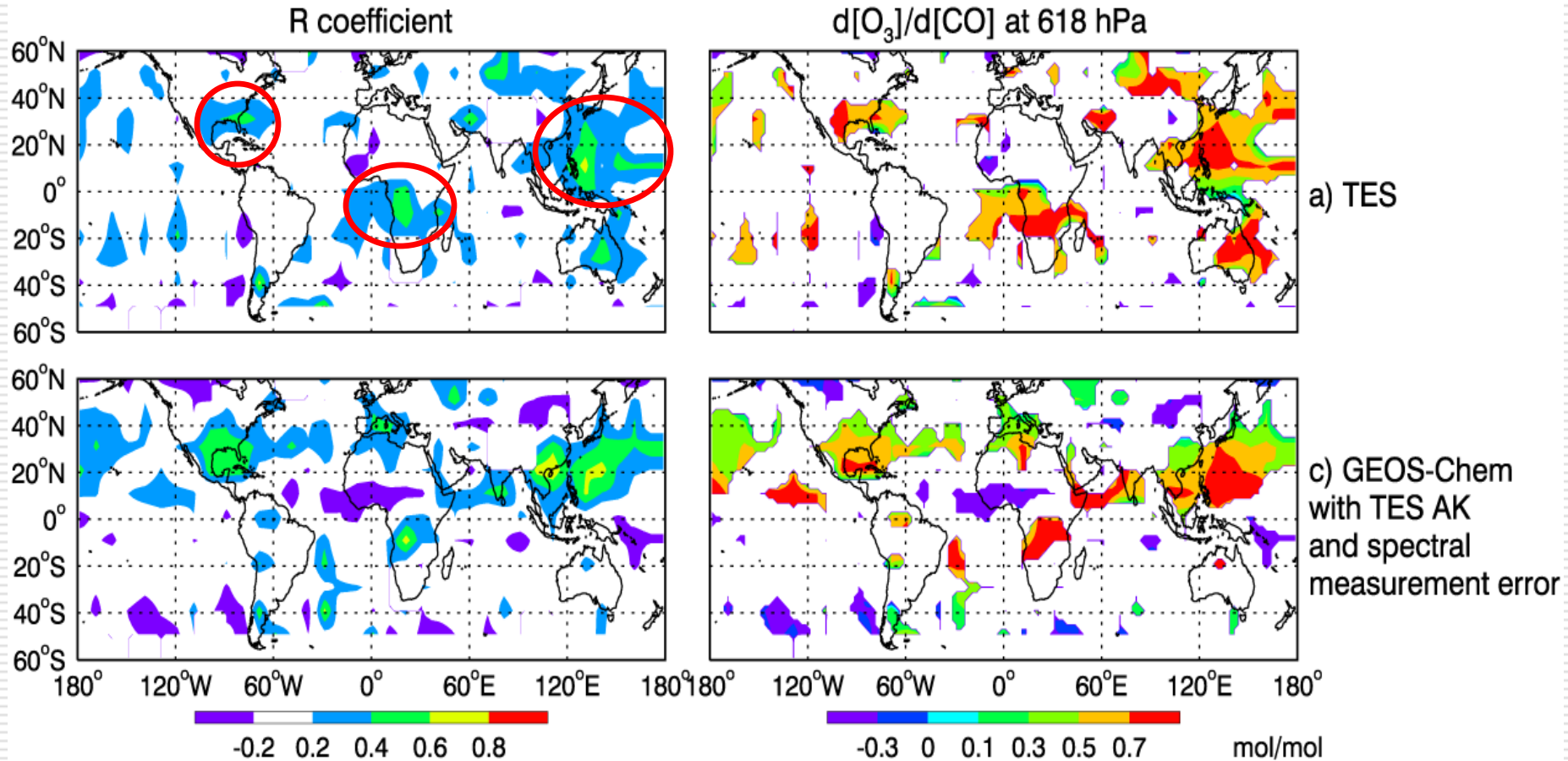


b) GEOS-Chem
with TES AK

O₃-CO correlations from TES provide an valuable test of anthropogenic influence on ozone in global models.

Effect of retrieval error

July 2005

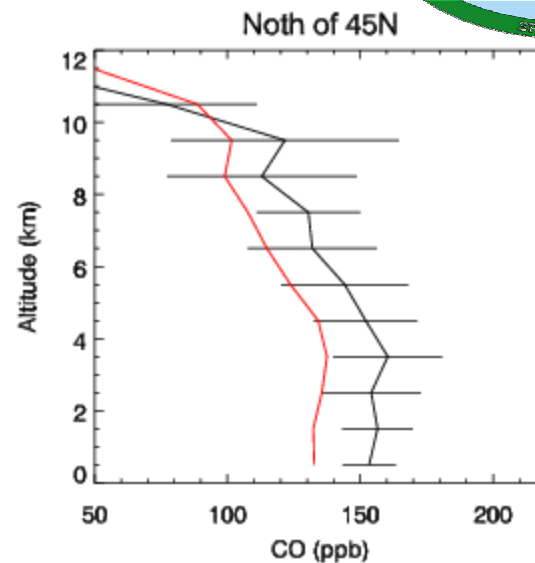
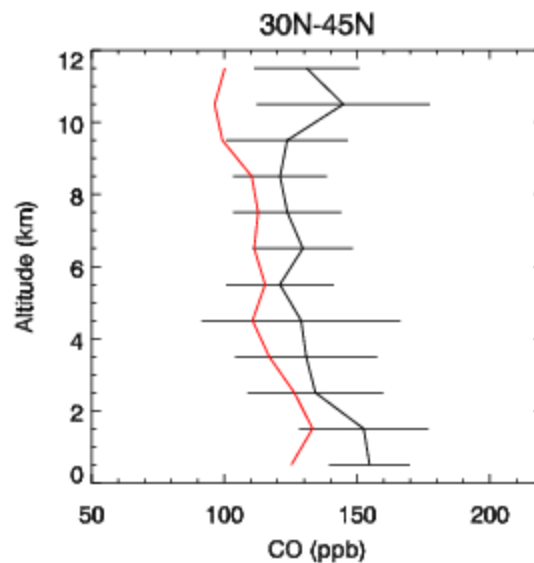
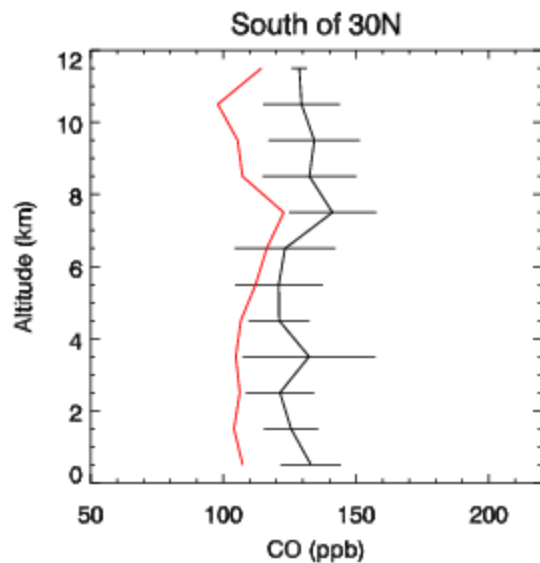
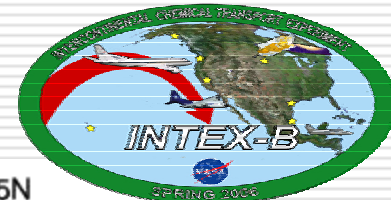


$$\hat{\mathbf{x}} = \mathbf{x}_a + \mathbf{A}(\mathbf{x} - \mathbf{x}_a) + \mathbf{G}\boldsymbol{\varepsilon}$$

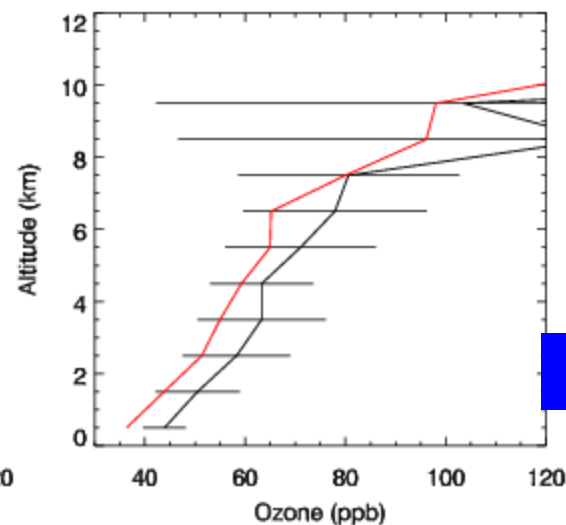
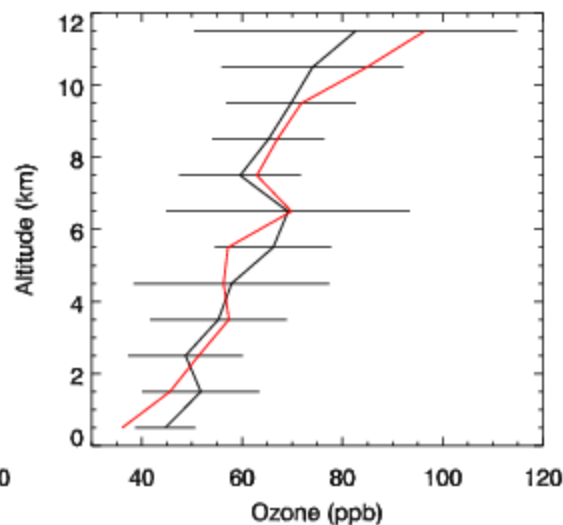
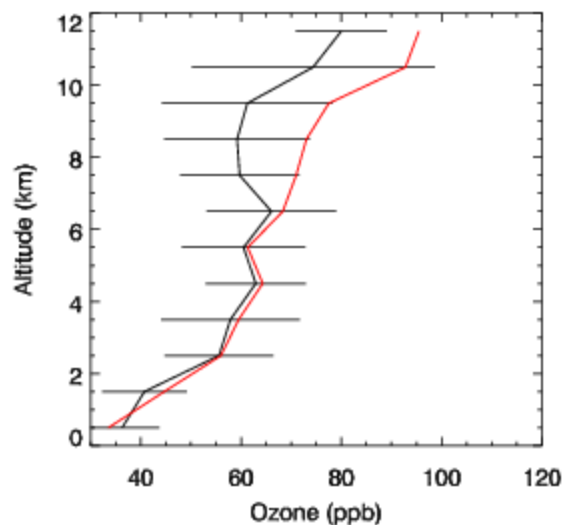
Apply random retrieval error to each model vertical profile

INTEX-B Mean CO and ozone vertical profiles

April 23- May 15, 2006



CO

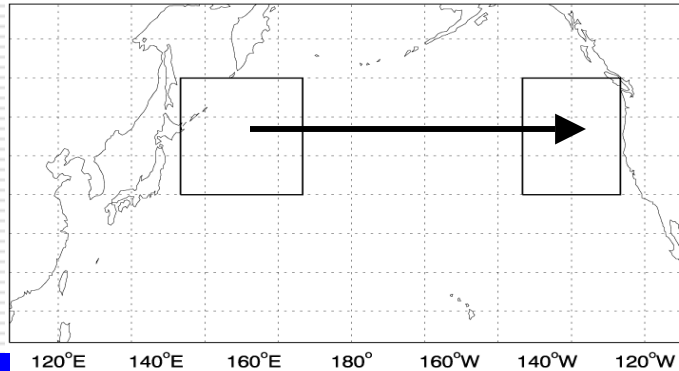


Ozone

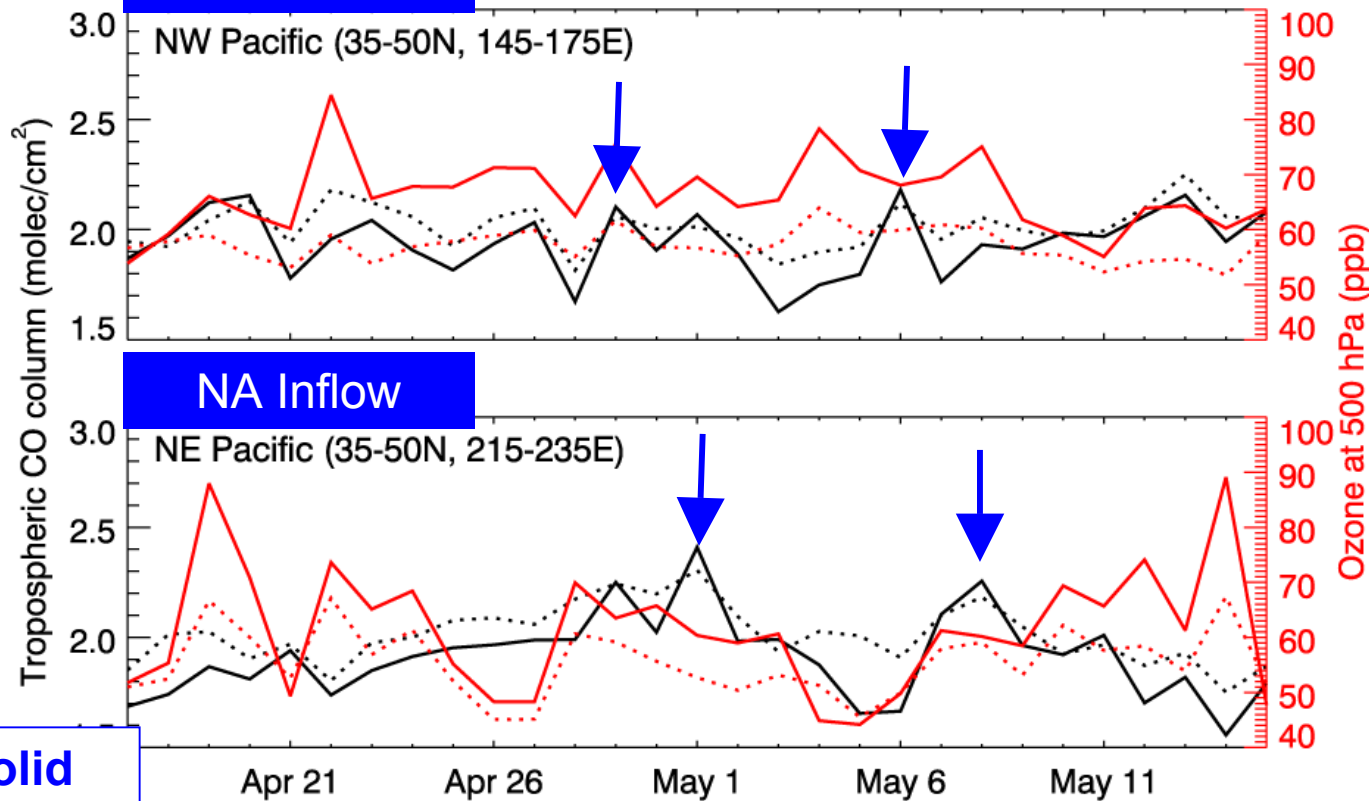
Black: INTEX-B measurements

Red: GEOS-Chem

Transpacific Transport observed from TES



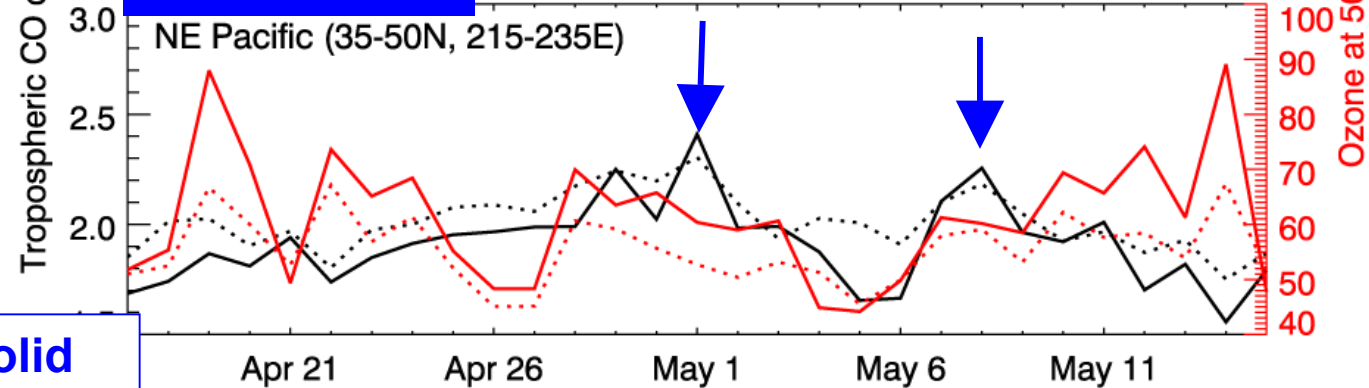
Asian Outflow



CO: R = 0.81

O3: R = 0.71

NA Inflow



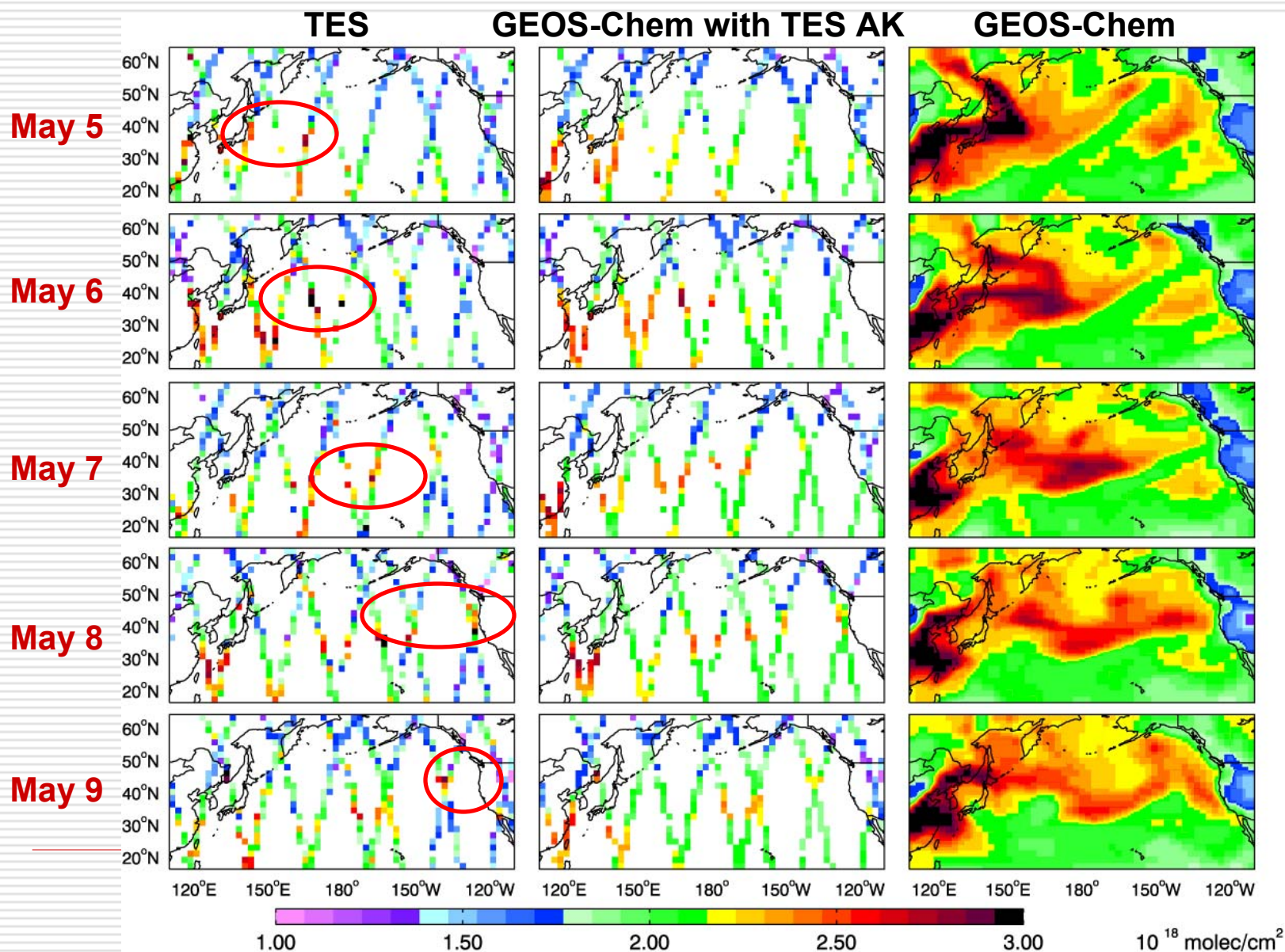
CO: R = 0.85

O3: R = 0.9

TES: solid
Model: dash

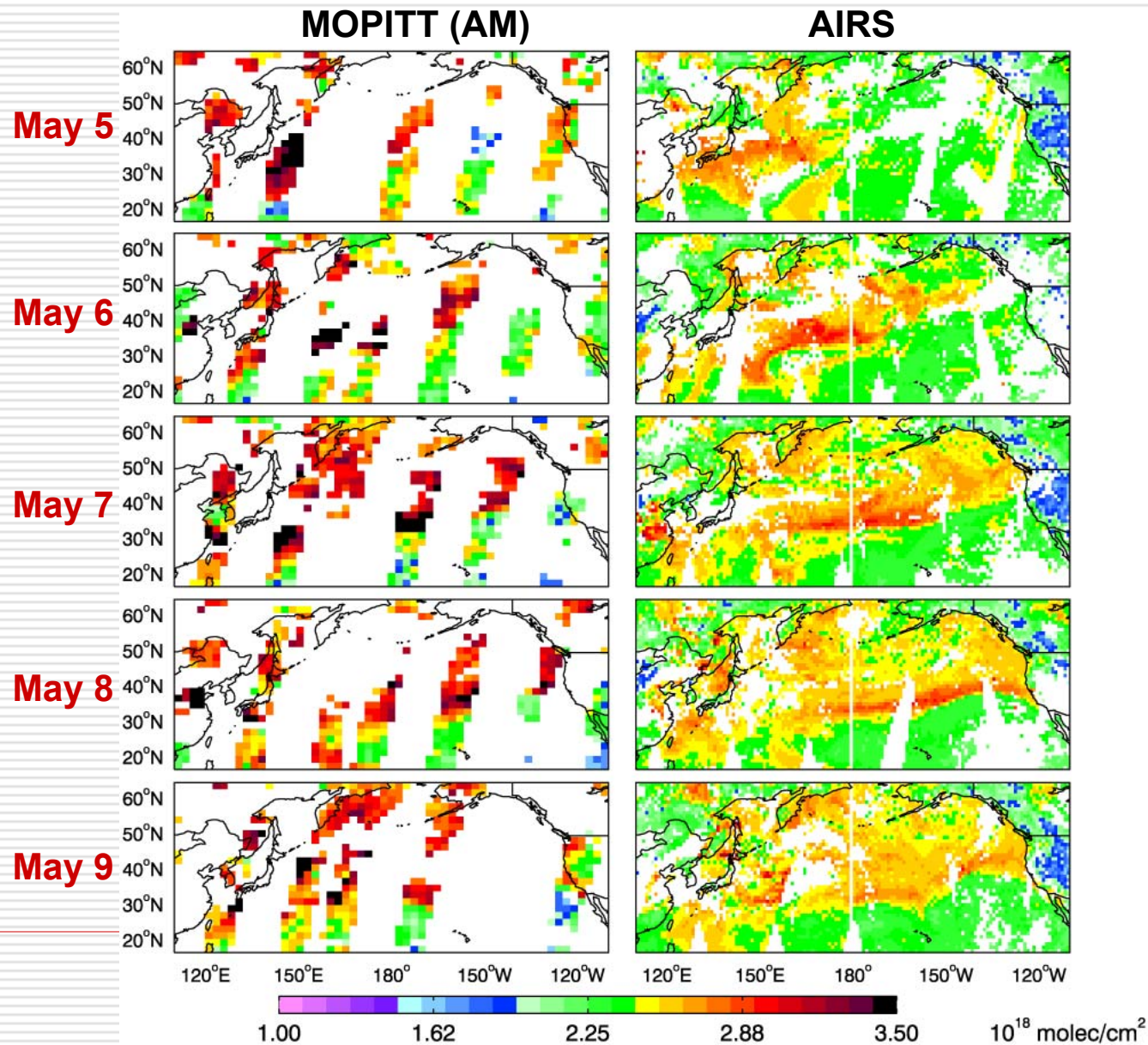
Transpacific transport of CO pollution

Tropospheric CO column



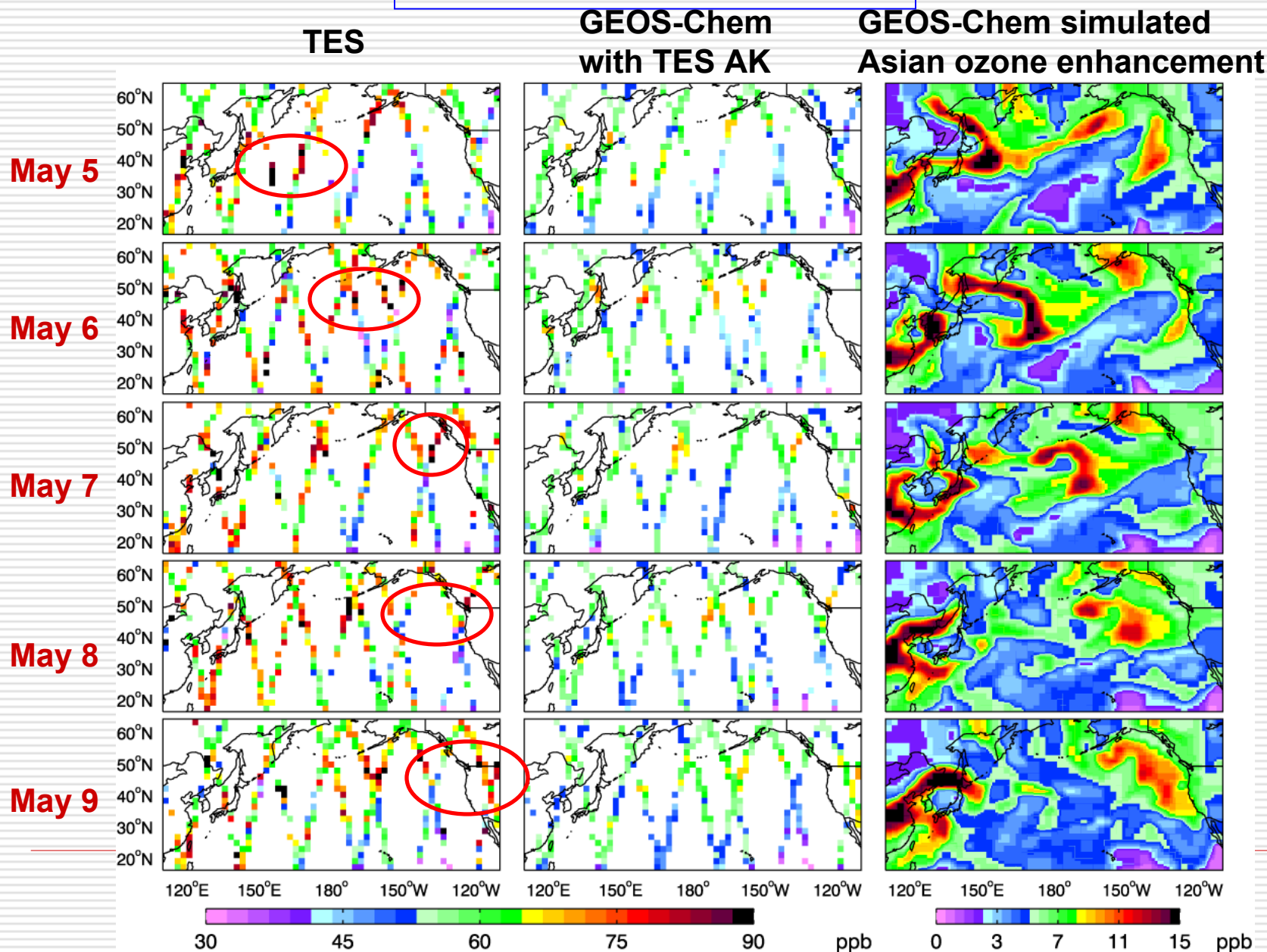
MOPITT and AIRS observations of the Asian plume

Total CO column

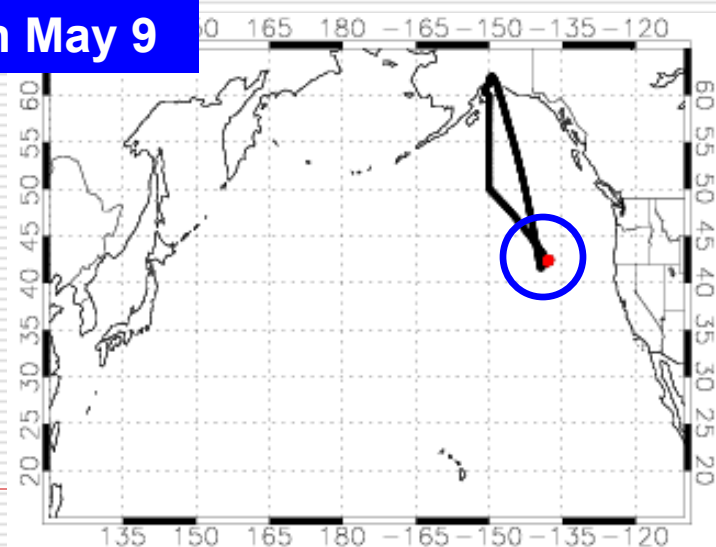
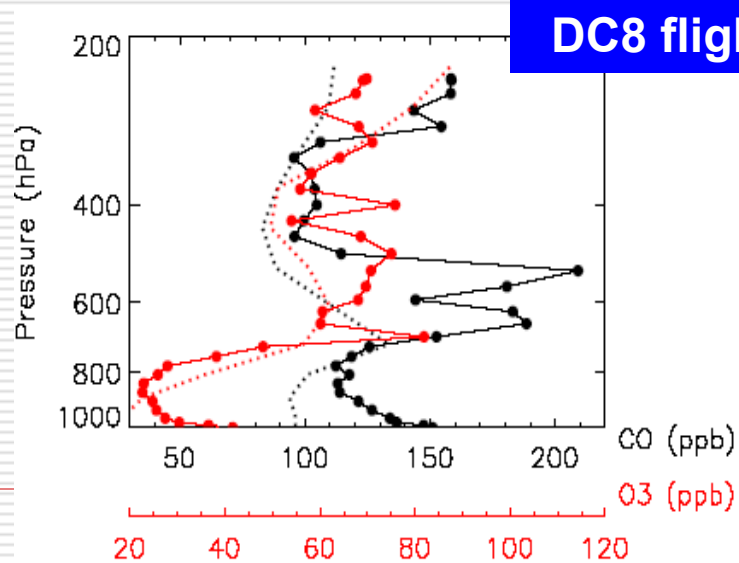
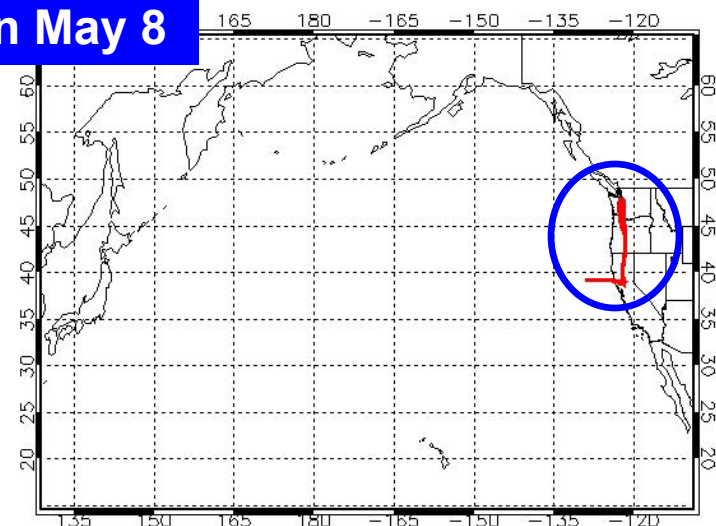
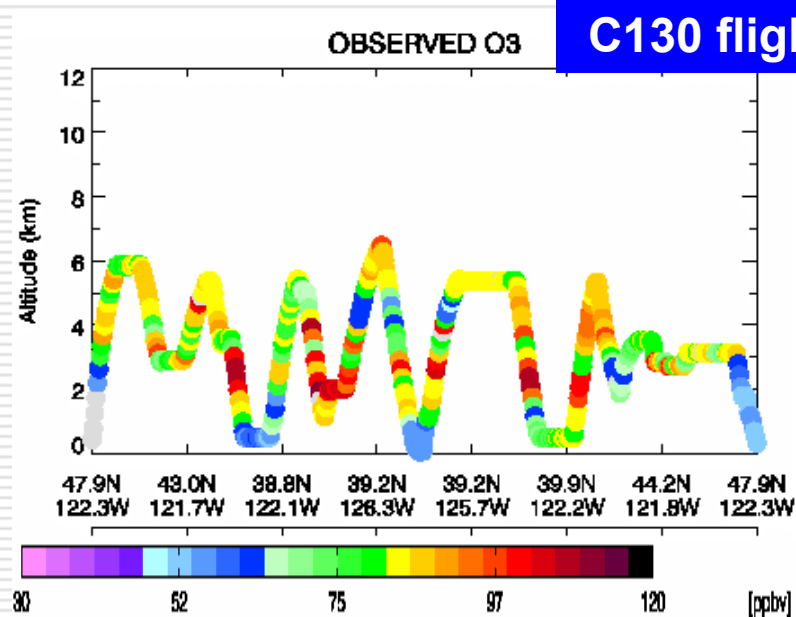


Transpacific transport of ozone pollution

Ozone concentration at 500 hPa

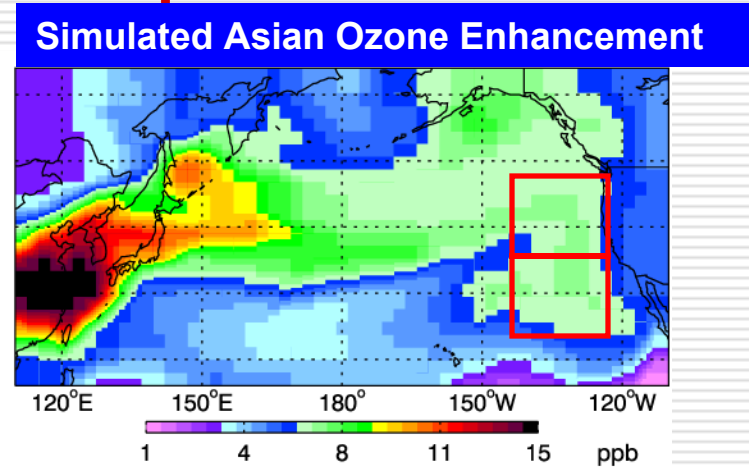
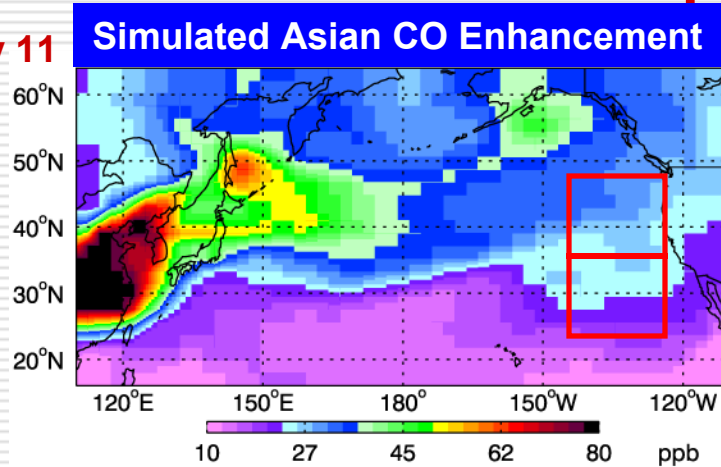


The May 5-9 transport event measured from aircraft



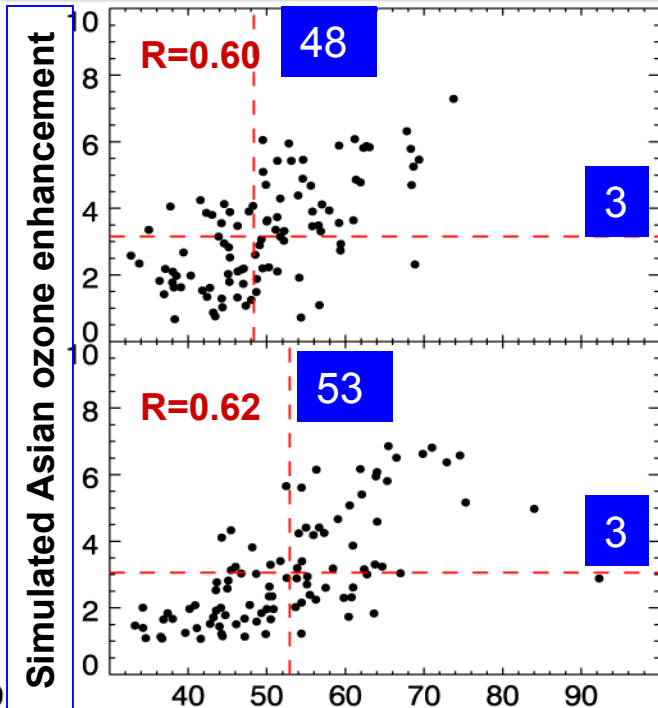
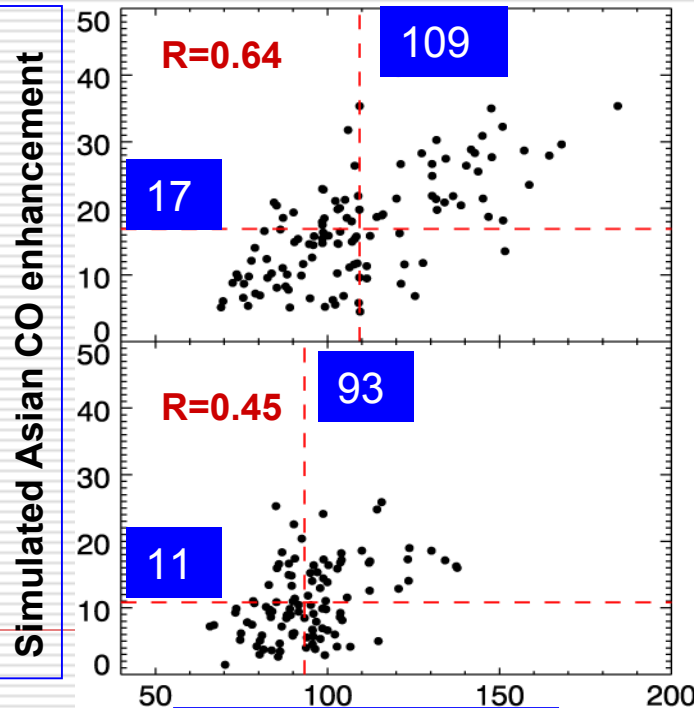
Ozone production in the transpacific plume

May 5 – May 11

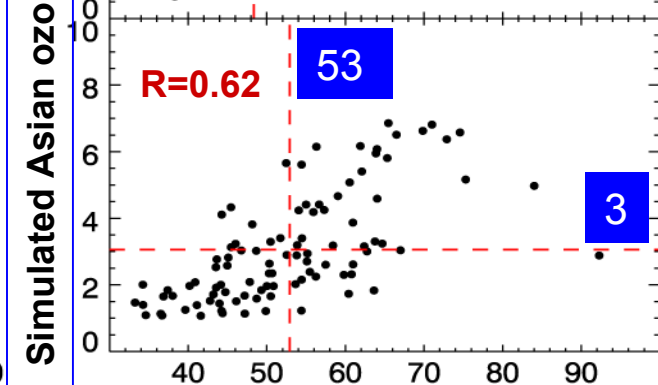
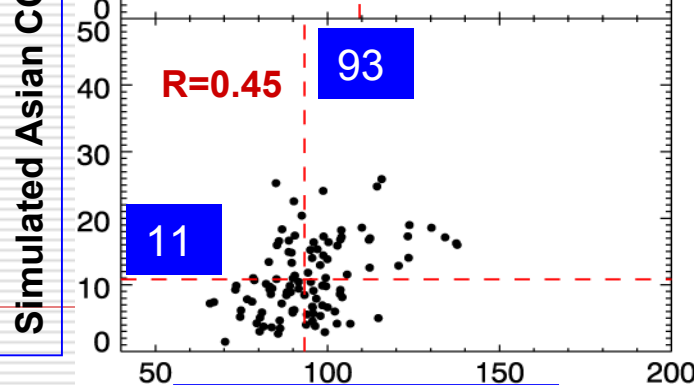


TES observation and simulated Asian enhancement at 618 hPa

Northern box



Southern box



Summary and future work

- TES observed significant positive O_3 -CO correlations in continental outflow at North mid-latitude in July.
- TES CO and ozone measurements provide useful insights in tracking transpacific transport and understanding ozone production through the transport.
- Combination with INTEX-B measurements of reactive nitrogen species will allow us to look into the ozone production efficiency in the transpacific plumes.
- Further study to assess the implication of Asian pollution plumes on US air quality.

